Standardization of DSM2 Studies

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Introduction

The use of *standards* is common throughout society and industry. For instance, automobiles have adopted standard placement of the accelerator, brake, and clutch foot pedals, regardless of make or model. The benefit of this standardization—less confusion when using different cars and therefore much less risk of accident and injury—far outweighs any possible advantage that different pedal placement could offer. In construction, states have adopted Uniform Building Codes that codify safe and efficient building practices, while still allowing architects freedom to design working and living spaces according to their clients' needs and aesthetics.

The authors believe that studies involving DSM2 could also benefit by adopting standard processes and inputs. By definition, however, "standards" must be adopted by almost all users to be effective. Therefore this paper seeks to start a serious dialogue among the DSM2 modeling community that will result in a set of useful and practical standards.

DSM2

Types of Studies

A series of DSM2 model runs, resulting in a study, consists of several steps involving assumptions about the proposed Delta configuration, input data, its description, and transformation of data. Standards will be helpful for all steps of a DSM2 study.

DSM2 studies generally fall into one of two basic categories: historical-based or planning. Planning studies can use either temporary or permanent barriers.

Historical-based studies, as the name implies, are based on historical (observed) inputs and Delta configuration. The base run would usually be a complete historical run, perhaps identical to a validation run. Selected inputs and/or components in the configuration that are to be studied would then be altered from historical values to serve as the comparison runs for the study. *Forecasting* studies may be considered a variation of historical-based studies; the model is warmed up with recent historical data, then run with projected near-term future conditions.

Planning studies use greatly modified flows from CALSIM studies or similar sources. They correspond only loosely to historical conditions, and may be better thought of as more akin to a synthetic hydrology. To examine different flow regimes in a current Delta configuration, *temporary* barrier (gate) operations in the South Delta are calculated as a pre-run process and executed during the run. To simulate expected future long-term configurations, *permanent* barriers are used in place of temporary barriers. Their placement and operation is significantly different than temporary barriers.

Text vs. DB Version

The current production version of DSM2 receives non-time-varying input from text files. This offers maximum flexibility, but it is very difficult to control file versions and to see how versions differ, resulting in a hodge-podge of subtly different files for different studies which are copied among users.

The database version of DSM2 (http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/news.cfm) eliminates much of the confusion and ambiguity of the text version, among other new features, by consolidating almost all non-time-varying data into a relational database. Access to the RDB is through a Graphical User Interface. The combination results in a system that is still flexible but differences in component versions can be readily identified and shared in their exact form between users. Because of this important addition as well as other features, this paper assumes the use of the new, database version of DSM2.

Areas of Proposed Standards for DSM2

Delta Components (Input Data)

It is helpful to think of the Delta as consisting of many physical components (features) which can be selected to assemble a particular Delta configuration for a study. The historical Delta serves as a starting point for all other configurations. By altering some components (e.g. dredged channels, pumping capacity, flows), adding others (permanent barriers, a Through-Delta Facility), and removing still others (temporary barriers), the final configuration can change significantly from the historic.

Accepting standard parameters and placement of components not directly under study can result in substantial benefit to the DSM2 community. For instance, in the past, studies were done of different configurations of Franks Tract, and the TDF, but not in coordination with each other. Later, it was desirable to evaluate the two independently-performed studies with each other to develop a sense of comparative water quality benefits of the two potential facilities. But it was not practical to do a comparison since the studies used different input components: flows, exports, and Delta physical configuration.

Metadata (Study Documentation)

Metadata is a description of data. In this discussion, metadata will be a description of the assumptions and input data comprising a study: The important CALSIM study descriptions (Level of Development, water quality standards, etc.), gate operations, explanation of barriers and operations, and so forth. Metadata is important to document the characteristics of a study so that interested parties in the future know what went into it.

Scripts, Functions, Conversion Equations

Some inputs must be prepared before a planning DSM2 run, such as smoothing monthly CALSIM flows, calculating the Martinez EC boundary, and setting gate positions. These inputs are prepared using a variety of scripts in Python and Excel, and different persons have developed different methods to accomplish the same objective. For instance, an internal review in Delta Modeling revealed four distinct scripts for calculating the Delta Cross Channel gate position. Standard scripts should be developed for each common function needed, well-documented, and placed in a shared common area. These can also be made available via the Informix relational database system.

In this category we also include empirical equations to convert between water quality parameters (for instance, EC, Cl^{-}, TDS). The conversions are quite dependent on assumptions made to account for the salt source (ocean or agriculture), and standardizing on accepted equations would remove another variable in the effort to make studies directly comparable.

Output Analyses

Even the best model studies are of little benefit if their output and reduction is not carefully designed. While individual studies will certainly have their own output and reporting requirements, some general output locations and types of data, and standard reduction and reporting, will be important to comparing results between studies.

Input Variation/Time Scales

In the real Delta hydrologic and tidal variations happen every instant. In the model world such detail is not possible so simplifying assumptions are made. Currently DSM2 uses a mix of variation: CALSIM hydrology is usually produced with a monthly average variation, the adjusted-astronomical tide at Martinez is an improvement over the previously used repeating tide, and a 16-year period is assumed to represent the larger 73-year period, which in turn is assumed to represent future hydrology.

How good are these assumptions? Why not just routinely use a 73-year run with adjusted astronomical tide and daily hydrology? We are close to being able to do the latter, but running time and post-run analyses may still be too long to do so routinely. If so, we need information on what kind of simplifications we can safely make without compromising the results.

Latest Accomplishment of Establishing Standards

CBDA-BDPAC Common Assumptions Work Team

The Common Assumptions effort was initiated by the California Bay-Delta Public Advisory Committee (BDPAC) Water Supply Subcommittee in early 2002. The objectives of this effort are to develop common model codes, common quantification of model inputs and outputs, common analysis procedures, and common performance measures for the California Bay-Delta Authority (CBDA) potential surface storage projects. The four specific projects involved in this effort are North of Delta off-Stream Storage (NODOS), In-Delta Storage (IDS), Shasta Reservoir Enlargement, and Los Vaqueros Expansion.

To facilitate comparison among these projects and potentially other water management options, a Common Model Package for the CALSIM II and the DSM2 models is being developed by the work team. The work team believes it is important to define a common set of input assumptions and data sets, and also to establish common modeling protocols. This entire process has been the Common Assumption activity coordinated between all project teams and the focus is to develop consistency among the four individual projects.

The Common Assumptions work team recently completed the Progress Report Model Package (includes CALSIM II and DSM2 Interim Baselines and common reporting metrics) and initiated consistency checks on model applications for individual storage projects. This latest achievement not only promotes the concept of using consistent and standard process and inputs to ensure a sound comparison between projects but also demonstrates that there is a need to use standards as a foundation for quality modeling studies.